

## DEPARTMENT OF THE INTERIOR WEATHER PROGRAMS

The Department of the Interior's (DOI) Atmospheric Science activities are primarily research and, historically, have been reported through the Subcommittee for Atmospheric Research. However, budgetary information for the Bureau of Land Management's operational wildfire weather data collection system is reported in this Federal Plan. The narrative below describes the full-range of meteorological activity in the Interior Department.

### Bureau of Land Management (BLM)

Bureau of Land Management is one of five Federal Land Management agencies which have centralized Wildland fire weather operations at the National Interagency Fire Center (NIFC), Boise, Idaho. BLM's Initial Attack Management System (IAMS) was designed in the mid-1980's to provide real-time data access and modeling for the fire management organization. The IAMS requires considerable dedicated telecommunications network for data distribution. In an effort to reduce these inherent telecommunications costs, the BLM has moved to a "web server" environment. This new system is called the BLM Wildland Fire Management Information Site (WFMIS) ([www.nifc.blm.gov](http://www.nifc.blm.gov)). Many of the capabilities that were centrally located in the old IAMS have been moved to other web sites.

The principal inputs to WFMIS are Remote Automatic Weather Station (RAWS) and National Lightning Detection Network (NLDN) information. Additional fire management information is summarized and available at the Western Regional Climate Center ([www.wrcc.sage.dri.edu](http://www.wrcc.sage.dri.edu)) and the United States Forest Service Wildland Fire Assessment System ([//svinet2.fs.fed.us/land/wfas/](http://svinet2.fs.fed.us/land/wfas/)) web sites.

The BLM's RAWS Program primarily collects meteorological data for fire weather forecasting. In past years, the network also provided considerable support to non-fire entities and was operated throughout the year. However, with increased pressure on operational dollars, the BLM Office of

Fire and Aviation Management has decided to restructure its network. Plans were to reduce the fire network by about one-fourth in the western states. However, after considerable study and optimization, actual reductions have been about 15 percent. With continued funding pressures, the requirement to replace aging equipment and the considerable costs associated with maintaining such a large network, BLM Fire Management's strategy was to reduce the total number of RAWS, move to a single station classification (all stations configured the same), operate only during the traditional western fire season (RAWS no longer maintained in winter months), and to use any savings in operating funds to replace aging equipment and upgrade the remaining network. However, once again, the expanded use of Fire Managements RAWS data set by other non-fire users has generated funding to permit year-round operation of the entire network. The BLM's Resource Management and Oregon O&C (West-Side) RAWS networks will continue to operate and be supported as in the past. These networks are much smaller and have specific program requirements that differ from fire management.

In 1997, the BLM began contracting with a private vendor via the National Weather Service (NWS) for lightning location data. Data is received at the NIFC in Boise, Idaho, and placed on the BLM WFMIS for access by qualified users. Current plans are to continue the operation of the Alaska Automatic Lightning Detection System as an independent government-owned and operated system.

The BLM's Remote Sensing Fire Weather Support Unit at NIFC provides a full range of specialized management, maintenance, data, and support services for the BLM and numerous other government agencies. This interagency staffed and funded facility performs work under long-term interagency agreements with those agencies within the government having similar equipment and requirements. Staffing levels within this group are being adjusted to meet the overall interagency requirements.

In addition to the meteorological monitoring BLM performs primarily to support wildland fire management activities, BLM also conducts site-specific climate monitoring at over 200 manual weather station locations on the Public Lands in the eleven western states and Alaska. The operation of these sites ranges from seasonal to annual measurements of precipitation, temperature, soil moisture, and other meteorological parameters necessary to assess local climatic influences. These data are primarily used for natural resources management and planning at the local level.

In 1991, the BLM Global Change Research Program established five monitoring sites in BLM wilderness and wilderness study areas to establish baseline conditions for assessment of long-term ecosystem trends. A total of 20 sites were planned to be established over the initial 5-year period. A standardized monitoring platform is operating at these sites and includes measurements of climate and atmospheric chemistry.

#### National Park Service

The National Park Service (NPS) monitors air quality and visibility in several national parks and monuments. Gaseous pollutants data are collected on continuous and integrated (24-hour) bases. Surface meteorological data are collected and analyzed for hourly averages. Precipitation chemistry is determined on week-long integrated rainfall samples. Twenty-four hour, average particle concentrations (mass, elemental analyses, some chemical constituent analyses) are measured twice weekly. Atmospheric light extinction is measured continuously and relayed to a central location for analyses.

The NPS also conducts and contracts research to develop and test air quality models to assess long-range transport, chemical transformation, and deposition of air pollutants. These models are used to estimate source contributions to, and to identify source regions responsible for, observed pollutant loadings.

#### United States Geological Survey

The United States Geological Survey's (USGS or Survey) Water Resources Division (WRD) collects streamflow, precipitation, and other climatological data for a number of projects concerning rainfall/runoff, water quality, and hydrologic processes. Currently, the Geological Survey collects hydrometeorological data from approximately 4,500 remote data collection platforms (DCPs). The data are transmitted to Wallops, Virginia, via GOES and rebroadcast to a domestic communication satellite (DOMSAT). Data are received from the DOMSAT by local readout ground stations (LRGS) procured by the Geological Survey under a 1992 contract. The Survey currently operates 12 LRGS's which provide near real-time data to the Survey's computerized National Water Information System.

USGS/WRD is providing the NWS real-time data that will help calibrate the NEXRAD weather radar for precipitation analysis. WRD is operating

37 rainfall collection sites data in the Susquehanna River Basin which provide hourly updates of precipitation. This pilot program, started in 1997, will continue with the objective of identifying procedures for data collection and exchange, and developing a model local agreement that can be used by other NWS/USGS Offices in an operational program.

The USGS is continuing a joint research program with the National Aeronautics and Space Administration and the United States Department of Agriculture to map snowpack water equivalent or depth using satellite passive microwave observations from the Defense Meteorological Satellite Program SSM/I sensor. The satellite observations are being compared to snowpack data from a variety of sources: USDA's Natural Resources Conservation Service automatic Snow Telemetry (SNOTEL) sites; NWS sites; and grain size, density, and stratigraphy observations by USGS field teams. The program objective is to develop algorithms to extract snow depth or water equivalent information from the satellite observations for near real-time assessments and for climatological studies using the 20 year satellite record. An algorithm has been developed that combines the satellite observations with surface temperature measurements to account for changing snowpack grain size--a factor that was not included in previous algorithms.

As part of its glaciology program, the Survey maintains a benchmark program on three benchmark glaciers representative of different climatic zones of the western United States. These benchmarks are in Washington, on the south coast of Alaska, and in the interior of Alaska. At each glacier, the program measures the winter snow accumulation, summer snow and ice ablation, air temperature, and runoff in the glacier basin. Analysis of this 36-year long record is providing a greater understanding of the climate variability and its effects on water resources in the western United States.

The Survey's Geologic Division, through the National Geomagnetic Information Center (NGIC) in Golden, Colorado, collects data on temporal variations of the Earth's magnetic field from a global network of over 70 geomagnetic observatories. These observatories (which include 13 operated directly by USGS/NGIC) all belong to the INTERMAGNET program. Under INTERMAGNET, data from a global network of geomagnetic observatories are transmitted in near real-time via satellites and computer links (email). These collection and dissemination points are called Geomagnetic Information Nodes (GIN's). There are 5 GIN's located in Europe, North America, and Asia.

Magnetic field data are key inputs to the National Space Environment Forecast and Warning Program and to the new interagency National Space Weather Program. These data are used for nowcasting, forecasting, and modeling of "space weather"--particularly the effects of geomagnetic disturbances. These geomagnetic effects include: satellite computer upsets and early re-entry, disruption of radio communications, degradation of navigation systems, such as GPS, and outages of power distribution grids. The roles and responsibilities of agencies participating in the National Space Environment and Warning Program are detailed in the "*National Plan for Space Environment Services and Supporting Research, 1993-1997*" (FCM-P10-1993) which was prepared by the OFCM Committee for Space Environment Forecasting.

The Survey participates in OFCM's Working Group on Volcanic Ash (WG/VA). This committee is preparing a "National Framework for Volcanic Ash Hazards to Aviation." Through its Volcanic Hazards Program, the Survey is responsible for monitoring volcanoes in the United States. Of the approximately 56 historically active volcanoes in the United States, 44 are in Alaska. Prior to the

past decade, the Alaskan volcanoes have been largely unstudied. Despite the low population density of the state, Alaska's volcanoes underlie the heavily traveled air routes of the North Pacific region.

The WG/VA has supported expansion of USGS monitoring activities in the remote Aleutian chain of explosive volcanoes. During FY 1996, USGS and the Alaskan Volcano Observatory (AVO) expanded its network of real-time seismic monitoring stations to 4 additional volcanoes in the Eastern Aleutian Islands and the Western Alaskan Peninsula. This expansion enabled the AVO to place 10 volcanoes under continuous, real-time surveillance. Data and information from the AVO monitoring activities are integrated directly into the regional operational activities of the FAA, DOD, and NWS to provide warnings for pilots and aircraft operators in the Alaskan region.

The Survey also carries out research in past climate change, regional hydrology, the carbon cycle, coastal erosion, volcanic activity, and glaciology. As part of its glaciology program, the Survey continues to measure the winter snow accumulation, summer ice ablation, and net balance on three glaciers representative of different climatic zones of the western United States--one in Washington and two in Alaska. The analysis of this 35-year long record is providing a greater understanding of the climate variability in the western United States. The Survey collects precipitation samples in a number of studies for the determination of atmospheric contribution to the chemical constituent loads to runoff and for defining the effect of atmospheric deposition on water quality and the aquatic environment.

#### Bureau of Reclamation

The Bureau of Reclamation activities requiring the collection and use of meteorological data include water scheduling, flood hydrology, irrigation project management, and reservoir

operations as well as projects related to hydroelectric energy resources. One example of this is the Agricultural Water Resources Decision Support (AWARDS) system which integrates high-resolution NEXRAD radar rainfall estimates, surface environmental data, crop models, and quantitative precipitation forecasts, with watershed reservoir-canal systems and irrigation district water distribution systems. AWARDS provides operational support for: (1) early warnings to reduce hydrologic risk for loss of property and lives, (2) improved efficiency in canal and reservoir operations, and (3) improved efficiency in irrigation scheduling for water conservation and water quality.

Reclamation continues to develop a prototype Snow Accumulation Algorithm (SAA) for the recently installed national network of about 160 Doppler weather radars. This development is a cooperative effort with primary support from the tri-agency WSR-88D Operational Support Facility in Norman, Oklahoma. The prototype SAA has been successfully field tested in real-time at NWS Forecast Offices in Albany, New York, Cleveland, Ohio, and Minneapolis, Minnesota. The SAA continues to be improved with data sets from all climatic regions in the nation which have frequent snowfall.

Reclamation's NEXRAD research team is also conducting cooperative work with NOAA's Global Energy and Water Cycle Experiment (GEWEX) Continental-Scale International Program (GCIP). GEWEX is part of the World Climate Research Program. This work involves developing a correction scheme for known SAA snowfall under-estimation at far range caused by the curvature of the earth and the vertical profile of radar reflectivity. Reflectivity during snowfall has maximum values near the ground. In addition, Reclamation and GCIP are cooperating on providing SAA snow water equivalent (SWE) estimates to the

NOAA National Operational Hydrologic Remote Sensing Center which will incorporate them into their overall scheme of SWE and snow cover mapping for the nation. These spatial snow distributions are used by NWS River Forecast Centers and other agencies as input to runoff and stream-flow models. Therefore, improved knowledge of SWE and snow cover distributions, resulting from including NEXRAD radar estimates, will provide more accurate steamflow forecasts. Improved forecasting will, in turn, allow better management of water resources.

Reclamation meteorologists are working on modifying their snow accumulation algorithm into a Rain Accumulation Algorithm (RAA). This algorithm will provide a means of real-time estimation of rain volumes and rates over areas of particular interest. For example, Reclamation water managers need real-time warnings concerning flash flooding into reservoirs for which dam safety is a concern. Another example is accurate estimation of rainfall onto irrigation districts as part of the AWARDS system discussed earlier.

Multi-agency work on projecting potential effects of climate change and climate variability on western water resources and Bureau operations is continuing under collaborative work with the GEWEX with NOAA's Office of Global Programs, and the National Centers for Environmental Prediction (NCEP). The NWS River Forecast Centers provide detailed streamflow forecasts for Reclamation's operations. Of note is the technology transfer effort in the Central Valley Operations Office in Sacramento, where a direct workstation link to the NWS River Forecast System and other hydrometeorological forecast products will provide Reclamation's water managers with access to detailed products of immediate value to water management operations.

A Technology Advancement Study in collaboration with NCEP and the National Center for Atmospheric Research are examining the utility of mesoscale models for simulation and prediction of extreme precipitation events. These modeling efforts are taking current technologies and applying them to very heavy precipitation events to determine maximum precipitation and better understand limits of extreme precipitation in watersheds above Reclamation facilities for safety of dams studies and early warning applications.

Currently, Reclamation's HYDROMET system collects data from approximately 400 hydrometeorological DCPs which transmit data in the "real-time" through the GOES to the Bureau's DRGS in Boise, Idaho. AGRIMET is another network of 60 DCPs dedicated to analysis of crop water use and water conservation in the Pacific Northwest. Data collected and products created in Boise are electronically transferred to other Bureau, federal, and state offices. Funding for Reclamation's Global Change Response Program ended in the mid-1990s. Reclamation's weather modifi-

cation research program has not been funded since 1989 except for reimbursable work.

#### Minerals Management Service

The Minerals Management Service's (MMS) Environmental Studies Program gathers offshore environmental data for use in the management of offshore oil and gas resources. Currently, MMS is funding the continued operation of five meteorological buoys which transmit data via NOAA satellites. Two buoys are located in the Gulf of Mexico and two in the Pacific Ocean off California. The MMS also utilizes data from other buoys funded by NOAA. The buoys collect air temperature, sea surface temperature, wind direction, wind speed, wave height, and wave spectrum data.

In FY 1998, the MMS started data collection from two 915 MHz profilers with Radio Acoustic Sounding System capabilities to study the atmospheric boundary layer over the Gulf of Mexico. One profiler is located on a platform about 6 miles off the central Louisiana coast; the other is placed in deeper waters about 130 kilometers from shore. Hourly observations are transmitted to the NWS via GOES

satellite on a real-time basis for use in prognostic models. Data collection started in June 1998 and will last for three years. Each site also collects surface data on wind, temperature, relative humidity, atmospheric pressure, and sea surface temperature.

The MMS has requested the offshore oil and gas industry to establish a network of meteorological stations in the area around the Breton National Wilderness Area in Louisiana to collect data for air quality modeling. Surface data will be collected from platforms and buoys and one or two upper air sites will be installed as well. This effort is to be funded by industry and is expected to start about January 2000. Data will be collected for one year.

#### Bureau of Indian Affairs

The Bureau of Indian Affairs collects atmospheric data to evaluate potentially irrigable Indian Trust lands in the Southwest. The Bureau also shares fire weather data with other Federal agencies while participating in fire weather forecasting at the National Interagency Fire Center.